Lecture 17
More on Money

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Economics 312
Welfare cost of inflation

- Because money holdings yield direct utility and higher inflation reduces real money balances, inflation generates a welfare loss.

Questions:

- How large is the welfare cost of inflation?
- Is there an optimal rate of inflation that maximizes the steady-state welfare of the representative household?
The optimal rate of inflation addressed by Bailey (1956) and M. Friedman (1969).

Basic intuition: the private opportunity cost of holding money depends on the nominal rate of interest. The social marginal cost of producing money is essentially zero.

The wedge that arises between the private marginal cost and the social marginal cost when the nominal rate of interest is positive generates an inefficiency.

This inefficiency would be eliminated if the nominal rate of interest were zero.

So the optimal rate of inflation is a rate of deflation approximately equal to the real interest rate:

$$R = 0 \implies \pi = -r$$
Welfare costs of inflation: CIA Model

- In CIA models, inflation acts as a tax on goods or activities whose purchase requires cash.
- This tax then introduces a distortion by creating a wedge between the marginal rates of transformation implied by the economy’s technology and the marginal rates of substitution faced by consumers.
- Since the CIA model, like the MIU model, offers no reason for such a distortion to be introduced (there is no inefficiency that calls for Pigovian taxes or subsidies on particular activities, and the government’s revenue needs can be met through lump-sum taxation), optimality calls for setting the inflation tax equal to zero.
- The inflation tax is directly related to the nominal rate of interest; a zero inflation tax is achieved when the nominal rate of interest is equal to zero.
Money in the Long Run

- There is a high (almost unity) correlation between the rate of growth of monetary supply and the rate of inflation.
- There is no correlation between the growth rates of money and real output.
- There is no correlation between inflation and real output.
- These are consistent with the quantity theory.
Money Growth and Inflation: A High, Positive Correlation

Average Annual Rates of Growth in M2 and in Consumer Prices During 1960–90 in 110 Countries
Money and Real Output Growth: No Correlation in the Full Sample . . .

Average Annual Rates of Growth in M2 and in Nominal Gross Domestic Product, Deflated by Consumer Prices During 1960–90 in 110 Countries
Inflation and Real Output Growth: No Correlation

Average Annual Rates of Growth in Consumer Prices and in Nominal Gross Domestic Product, Deflated by Consumer Prices During 1960–90 in 110 Countries
Money and Business Cycles

- Relation between output and money. Money is pro-cyclical, more so prior to 1985.

- Other pieces of evidence:
  - Volcker’s recessions: Tightening of monetary policy in early 1980s seemed to lead to recessions.
  - Friedman and Schwartz (1963), *A Monetary History of the United States*: independent fluctuations in money supply were followed by changes in real output.

- Phillips Curve: tend to observe negative relationship between inflation rate and unemployment rate. Relationship not stable.
Growth in M1 and GDP

M1 Money Stock (M1SL)
Real Gross Domestic Product, 1 Decimal (GDPC1)

Shaded areas indicate US recessions.
2013 research.stlouisfed.org
Unemployment Rate and CPI Inflation Rate

Civilian Unemployment Rate (UNRATE)
Consumer Price Index for All Urban Consumers: All Items (CPIAUCSL)

Shaded areas indicate US recessions.
2013 research.stlouisfed.org
Phillips Curve: 1956–2004

Unemployment

Inflation

Phillips Curve: 1956–2004

Unemployment

Inflation

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Economics 312
Modeling Monetary Business Cycles

- In model so far money is neutral. Change in money has no effect on economic activity.
- Seems to hold in long-run, less so in short run. How to reconcile?
- Response #1: RBC denial. Evidence of effect of money is not causal. Observe $M$ leading $Y$ but also observe carrying of umbrellas leading rainfall. Increase in $M$ may reflect expectations of higher future $Y$.
- Response #2: Lucas (1972) imperfect-information model. Short-run effects of money supply caused by confusing changes in relative and aggregate prices. More on this next.
Figure 11.5 Procyclical Money Supply in the Real Business Cycle Model with Endogenous Money
Evidence that money is not neutral in the short-run. First: Why is money not neutral in a flexible-price economy?

Model due to Lucas (1972). Misperceptions of changes in money may have real effects.

Household makes labor supply decisions based on the real wage:

\[ w = \frac{W}{P} \]

Suppose that the substitution effect dominates in each period because of intertemporal substitution:

\[ N'(w) > 0 \]

Household observes nominal wage \( W \).
Economy is hit by shocks to productivity $A$ (that raise $w$) and to the money supply (that raise $P$).

With perfect information on $P$ (or $M$), household just finds:

$$w = \frac{W}{P}$$

and takes labor supply decisions.

But what happens if $P$ or $M$ are not observed?
The household observes $W$ going up.

**Signal extraction problem:** Must decide if $W$ goes up because $P$ goes up (since $W = wP$) or because $w$ went up.

Response is different. Both shocks (typically) increase *nominal* labor demand.

*Nominal* labor supply should respond (more) to a money shock.

But workers are forced to respond equally to both shocks, since don’t know which has happened.
Nominal labor demand is similar, but labor supply should not be.
Labor supply is given by an average of the desired responses.

- Smaller response of employment to a productivity shock.
- Larger response of employment to a money shock.
Effects of Shocks

- An anticipated change in money is neutral: as last time.
- An unanticipated one-time increase in the money supply:
  - Employment and hence output supply increases.
  - A similar logic implies output demand increases slightly.
  - Output increases and real interest rates fall.
  - Real money demand increases.
  - The price level increases (but less than if money neutral).
  - Once change in money is realized, real economy reverts to old levels with higher prices. Money is neutral in long-run.
- A productivity shock is qualitatively as in the RBC model.
  - Output supply increases by more than output demand.
  - Output increases and real interest rates fall.
  - Real money demand increases. Price level declines.
Figure 11.1 The Effects of an Unanticipated Increase in the Money Supply in the Money Surprise Model
Implications

• Then money supply surprises affect labor supply and with it total output. As output increases above expected level, unemployment decreases. Get an expectations-augmented Phillips curve.

• There is a fundamental natural unemployment rate $\bar{u}$ in the economy, depending on labor market institutions. (More on this later in class.)

• Idea dates to Friedman (1968) and Phelps (1968): The cyclical unemployment rate $u - \bar{u}$ depends on unanticipated inflation:

$$\pi = \pi^e - h(u - \bar{u})$$

• When $\pi = \pi^e$, $u = \bar{u}$. When $\pi > \pi^e$, $u < \bar{u}$. 
The Phillips curve shows the relationship between unemployment and inflation for a given expected rate of inflation and natural rate of unemployment.

- Relationship between $\pi$ and $u$ isn’t stable when $\bar{u}$ or $\pi^e$ change:
  - Higher $\pi^e$ implies a higher Phillips curve.
  - Higher $\bar{u}$ shifts Phillips curve to the right.

- A fall in TFP increases both expected inflation and the natural rate of unemployment. Shifts the Phillips curve up and to the right. Phillips curve unstable in periods with large TFP shocks.
Figure 12.05  The shifting Phillips curve: an increase in expected inflation
Figure 12.06  The shifting Phillips curve: an increase in the natural unemployment rate
Historical Shifts in Phillips Curve

- US in 1960s: expected inflation and the natural rate of unemployment are approximately constant. Stable Phillips curve.


- Monetary policy was expansionary in the 1970s, leading to high and volatile inflation. Relationship of unemployment and inflation broke down, but fairly stable relationship with unanticipated inflation.
Figure 5
NAIRU From Wage Phillips Curve

Unemployment Rate
NAIRU Estimate
Trend Unemployment
± 2 SE Bands for NAIRU

Changes in Natural Rate of Unemployment
Phillips Curve, 1956-2004

Expectational Phillips Curve: 1956–2004

Change in Inflation vs. Unemployment–Mean
Expectational Phillips Curve, 1956-1972
Policy Implications

- Monetary policy can have real effects . . . but only by surprising the public.
- Expected changes in monetary policy have no real effects.
- If people are rational, systematic misperceptions are impossible.
- In any case, surprising the public is not desirable.
- Conclusion: monetary policy should be transparent.
Implications & Critiques of the Model

- If most shocks are monetary:
  - The price level is procyclical. (Counter to data.)
  - Real wages are countercyclical. (Counter to data.)
- But if most shocks are real,
  - The price level is countercyclical. (As in data.)
  - Real wages are procyclical. (As in data.)
- How realistic is it to assume that prices or money are unobservable?
- Persistence problem: Effects of unexpected money supply only last short time (until realized).